

RD-29,605-4 is a Continuation-in-Part of
RD-29,605-3, which is a Continuation-in-Part
of RD-29,605-1

CLAIMS:

1. A multilayer article comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from at least one 1,3-dihydroxybenzene and at least one aromatic dicarboxylic acid, (ii) a second layer comprising a polymer comprising carbonate structural units, (iii) an adhesive layer comprising a polyurethane, and (iv) a substrate layer comprising at least one material selected from the group consisting of a thermoplastic resin, a cured thermoset resin, a metal, a ceramic, a glass, and a cellulosic material, wherein the coating layer is in contiguous contact with the second layer, and the adhesive layer is in contiguous contact with the second layer and the substrate layer.

2. The article of claim 1 wherein the coating layer comprises at least one 1,3-dihydroxybenzene selected from the group consisting of unsubstituted resorcinol, 2-methyl resorcinol, and mixtures thereof.

3. The article of claim 2 wherein the 1,3-dihydroxybenzene is unsubstituted resorcinol.

4. The article of claim 1 wherein the aromatic dicarboxylic acid is selected from the group consisting of isophthalic acid, terephthalic acid, naphthalene-2,6-dicarboxylic acid, and mixtures thereof.

5. The article of claim 4 wherein the aromatic dicarboxylic acid is a mixture of isophthalic acid and terephthalic acid.

6. The article of claim 5 wherein the ratio of isophthalic-derived structural units to terephthalic-derived structural units is about 0.25-4.0 : 1.

7. The article of claim 5 wherein the ratio of isophthalic-derived structural units to terephthalic-derived structural units is about 0.40-2.5 : 1.

8. The article of claim 1 wherein the copolyestercarbonate comprises about 10% to about 99% by weight arylate blocks.

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9. The article of claim 1 wherein the copolyestercarbonate comprises about 60% to about 98% by weight arylate blocks.

10. The article of claim 1 wherein the carbonate portion of the copolyestercarbonate comprises structural units derived from bisphenol A.

11. The article of claim 1 wherein the second layer comprises a bisphenol A polycarbonate.

12. The article of claim 1 wherein the second layer further comprises at least one colorant selected from the group consisting of dyes, pigments, metal flakes, and glass flakes.

13. The article of claim 1 wherein the adhesive layer comprises at least one polyurethane comprising structural units derived from at least one polyol selected from the group consisting of polyether polyols, polyester polyols, polytetramethylene ether glycol, hexamethylene glycol and polyols based on polybutadiene.

14. The article of claim 13 wherein the polyurethane comprises structural units derived from methylene diphenyl diisocyanate or methylene biscyclohexyl diisocyanate.

15. The article of claim 1 wherein the polyurethane comprises an aliphatic polyurethane film.

16. The article of claim 1 wherein the adhesive layer comprises a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene.

17. The article of claim 16 wherein the block comprising structural units derived from styrene comprises a hydrogenated styrene-diene block.

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18. The article of claim 16 wherein the adhesive layer further comprises at least one additional resinous material which is miscible with or compatible with that portion of the block copolymer which is not polyurethane.

19. The article of claim 18 wherein the additional resinous material is a copolymer comprising structural units derived from styrene.

20. The article of claim 1 wherein the multilayer article exhibits a ninety-degree peel force of at least 700 Newtons per meter.

21. The article of claim 20 wherein the multilayer article exhibits a ninety-degree peel force of at least 1750 Newtons per meter.

22. The article of claim 1 wherein the substrate layer comprises at least one thermoplastic resin selected from the group consisting of condensation polymers, polycarbonates, aromatic polycarbonates, bisphenol A polycarbonate, polyacetals, polyarylene ethers, polyphenylene ethers, polyarylene sulfides, polyphenylene sulfides, polyimides, polyamideimides, polyetherimides, polyetherketones, polyaryletherketones, polyetheretherketones, polyetherketoneketones, polyamides, copolyamides, polyesters, liquid crystalline polyesters, polyetheresters, polyetheramides, polyesteramides, polyestercarbonates, poly(alkylene dicarboxylates), poly(ethylene terephthalate), poly(1,4-butylene terephthalate), poly(trimethylene terephthalate), poly(ethylene naphthalate), poly(butylene naphthalate), poly(cyclohexanedimethanol terephthalate), poly(cyclohexanedimethanol-co-ethylene terephthalate), poly(1,4-cyclohexanedimethyl-1,4-cyclohexanedicarboxylate); polyarylates, a polyarylate comprising structural units derived from bisphenol A, terephthalic acid, and isophthalic acid; addition polymers, homo- and copolymeric aliphatic olefin and functionalized olefin polymers, polyethylene, polypropylene, thermoplastic polyolefin, ethylene-propylene copolymer, poly(vinyl chloride), poly(vinyl chloride-co-vinylidene chloride), poly(vinyl fluoride), poly(vinylidene fluoride), poly(vinyl acetate), poly(vinyl alcohol), poly(vinyl butyral), poly(acrylonitrile), acrylic polymers, poly(meth)acrylamides, polyalkyl (meth)acrylates, poly(methyl methacrylate) polymers of alkenylaromatic compounds,

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polystyrenes, syndiotactic polystyrene; acrylonitrile-butadiene-styrene (ABS), and acrylonitrile-styrene-acrylate (ASA) copolymers; and blends thereof.

23. The article of claim 1 wherein the substrate layer comprises at least one cured thermoset resin selected from the group consisting of those derived from epoxys, cyanate esters, unsaturated polyesters, diallylphthalate, acrylics, alkyds, phenol-formaldehyde, novolacs, resoles, bismaleimides, PMR resins, melamine-formaldehyde, urea-formaldehyde, benzocyclobutanes, hydroxymethylfurans, and isocyanates.

24. The article of claim 23 wherein the substrate layer further comprises a filler selected from the group consisting of glass fibers, carbon fibers, at least one thermoplastic resin, and mixtures thereof.

25. The article of claim 1 wherein the substrate layer comprises a filled, cured thermoset resin selected from the group consisting of reaction injection molding (RIM) compound, long fiber injection polyurethane (LFI-PU) foam, sheet-molding compound (SMC), bulk molding compound (BMC), thick molding compound (TMC), and an acrylic ester-derived thermoset resin comprising a polyphenylene ether.

26. The article of claim 1 wherein the substrate layer comprises at least one metal selected from the group consisting of aluminum and steel.

27. The article of claim 1 wherein thicknesses of layers are: a coating layer of about 2-2,500 microns; a second layer of about 2-2,500 microns; and an adhesive layer of about 8-2,500 microns.

28. The article of claim 1 which is an OVAD device; exterior or interior component for aircraft, automotive, truck, military vehicle; military automobile, military aircraft, military water-borne vehicle, scooter, motorcycle, including a panel, quarter panel, rocker panel, vertical panel, horizontal panel, trim, pillar, center post, fender, door, decklid, trunklid, hood, bonnet, roof, bumper, fascia, grill, mirror housing, pillar applique, cladding, body side molding, wheel cover, hubcap, door handle, spoiler, window frame, headlamp bezel, headlamp, tail lamp, tail lamp housing, tail lamp bezel, license plate enclosure, roof rack, or running board; an

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enclosure, housing, panel, or part for outdoor vehicles and devices; a wind turbine blade or housing; an enclosure for an electrical or telecommunication device; outdoor furniture; aircraft component; exterior or interior component for a boat or item of marine equipment, including trim, an enclosure, or housing; an outboard motor housing; depth finder housing, personal water-craft; jet-ski; pool; spa; hot-tub; step; step covering; a building or construction application including glazing, roof, window, floor, decorative window furnishing or treatment; a treated glass cover for a pictures, paintings, poster, or display item; an optical lens; ophthalmic lens; corrective ophthalmic lens; implantable ophthalmic lens; a wall panel or door; a counter top; protected graphic; an outdoor or indoor sign; an enclosure, housing, panel, or part for an automatic teller machine (ATM); an enclosure, housing, panel, or part for a lawn or garden tractor, lawn mower, or tool, including a lawn or garden tool; window or door trim; an item of sports equipment or a toy; an enclosure, housing, panel, or part for a snowmobile; a recreational vehicle panel or component; an item of playground equipment; a shoe lace; an articles made from plastic-wood combinations; a golf course marker; a utility pit cover; a computer housing; a desk-top computer housing; a portable computer housing; a lap-top computer housing; a palm-held computer housings; a monitor housing; a printer housing; a keyboard; a FAX machine housing; a copier housing; a telephone housing; a phone bezel; a mobile phone housing; a radio sender housing; a radio receiver housing; a light fixture; lighting appliance; reflector; network interface device housing; transformer housing; air conditioner housing; cladding or seating for public transportation; cladding or seating for a train, subway, or bus; a meter housing; antenna housing; cladding for satellite dishes; an coated helmet or item of personal protective equipment; a coated synthetic or natural textile; coated photographic film or photographic print; a coated painted article; coated dyed article; coated fluorescent article; or coated foam article.

29. A multilayer article comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from unsubstituted resorcinol, a mixture of isophthalic acid and terephthalic acid, and bisphenol A; (ii) a second layer comprising a bisphenol A polycarbonate optionally containing at least one colorant, (iii) an adhesive layer selected from the group consisting of a

polyurethane; an aliphatic polyurethane film; a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene; and a blend of (a) a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene, and (b) a resinous copolymer comprising structural units derived from styrene; and (iv) a substrate layer selected from the group consisting of a thermoplastic resin, a cured thermoset resin, a metal, a ceramic, a glass, and a cellulosic material;

wherein the coating layer is in contiguous contact with the second layer, and the adhesive layer is in contiguous contact with the second layer and the substrate layer; and wherein the multilayer article exhibits a ninety-degree peel force of at least 700 Newtons per meter .

30. A film assembly comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from at least one 1,3-dihydroxybenzene and at least one aromatic dicarboxylic acid, (ii) a second layer comprising a polymer comprising carbonate structural units, and (iii) an adhesive layer comprising a polyurethane.

31. A film assembly comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from unsubstituted resorcinol, a mixture of isophthalic acid and terephthalic acid, and bisphenol A; (ii) a second layer comprising a bisphenol A polycarbonate optionally containing at least one colorant, and (iii) an adhesive layer selected from the group consisting of a polyurethane; an aliphatic polyurethane film; a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene; and a blend of (a) a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene, and (b) a resinous copolymer comprising structural units derived from styrene.

32. A method for making a multilayer article comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from at

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least one 1,3-dihydroxybenzene and at least one aromatic dicarboxylic acid, (ii) a second layer comprising a polymer comprising carbonate structural units, (iii) an adhesive layer comprising a polyurethane, and (iv) a substrate layer comprising at least one material selected from the group consisting of a thermoplastic resin, a cured thermoset resin, a metal, a ceramic, a glass, and a cellulosic material, wherein the coating layer is in contiguous contact with the second layer, and the adhesive layer is in contiguous contact with the second layer and the substrate layer;

which method is selected from the group consisting of the method (i) comprising the steps of (a) preparing an assembly of coating layer and second layer, and (b) combining said assembly with separate adhesive layer and substrate layer; the method (ii) comprising the steps of (a) preparing an assembly of coating layer and second layer, (b) forming the adhesive layer adjacent to the substrate layer, and (c) combining said assembly with the adhesive layer / substrate layer combination; and the method (iii) comprising the steps of (a) preparing an assembly of coating layer, second layer, and adhesive layer, and (b) forming said assembly adjacent to the substrate layer.

33. The method of claim 32 wherein the assembly of coating layer and second layer is formed by coextrusion.

34. The method of claim 32 wherein forming said assembly adjacent to the adhesive layer is performed by extrusion coating, lamination or compression molding.

35. The method of claim 32 wherein the coating layer comprises at least one 1,3-dihydroxybenzene selected from the group consisting of unsubstituted resorcinol, 2-methyl resorcinol, and mixtures thereof.

36. The method of claim 35 wherein the 1,3-dihydroxybenzene is unsubstituted resorcinol.

37. The method of claim 32 wherein the aromatic dicarboxylic acid is selected from the group consisting of isophthalic acid, terephthalic acid, naphthalene-2,6-dicarboxylic acid, and mixtures thereof.

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38. The method of claim 37 wherein the aromatic dicarboxylic acid is a mixture of isophthalic acid and terephthalic acid.

39. The method of claim 38 wherein the ratio of isophthalic-derived structural units to terephthalic-derived structural units is about 0.25-4.0 : 1.

40. The method of claim 39 wherein the ratio of isophthalic-derived structural units to terephthalic-derived structural units is about 0.40-2.5 : 1.

41. The method of claim 32 wherein the copolyestercarbonate comprises about 10% to about 99% by weight arylate blocks.

42. The method of claim 32 wherein the copolyestercarbonate comprises about 60% to about 98% by weight arylate blocks.

43. The method of claim 32 wherein the carbonate portion of the copolyestercarbonate comprises structural units derived from bisphenol A.

44. The method of claim 32 wherein the second layer comprises a bisphenol A polycarbonate.

45. The method of claim 32 wherein the second layer further comprises at least one colorant selected from the group consisting of dyes, pigments, metal flakes, and glass flakes.

46. The method of claim 32 wherein the adhesive layer comprises at least one polyurethane comprising structural units derived from at least one polyol selected from the group consisting of polyether polyols, polyester polyols, polytetramethylene ether glycol, hexamethylene glycol and polyols based on polybutadiene.

47. The method of claim 46 wherein the polyurethane comprises structural units derived from methylene diphenyl diisocyanate or methylene biscyclohexyl diisocyanate.

48. The method of claim 32 wherein the polyurethane comprises an aliphatic polyurethane film.

49. The method of claim 32 wherein the adhesive layer comprises a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene.

50. The method of claim 49 wherein the block comprising structural units derived from styrene comprises a hydrogenated styrene-diene block.

51. The method of claim 49 wherein the adhesive layer further comprises at least one additional resinous material which is miscible with or compatible with that portion of the block copolymer which is not polyurethane.

52. The method of claim 51 wherein the additional resinous material is a copolymer comprising structural units derived from styrene.

53. The method of claim 32 wherein the multilayer article exhibits a ninety-degree peel force of at least 700 Newtons per meter.

54. The method of claim 53 wherein the multilayer article exhibits a ninety-degree peel force of at least 1750 Newtons per meter.

55. The method of claim 32 wherein the substrate layer comprises at least one thermoplastic resin selected from the group consisting of condensation polymers, polycarbonates, aromatic polycarbonates, bisphenol A polycarbonate, polyacetals, polyarylene ethers, polyphenylene ethers, polyarylene sulfides, polyphenylene sulfides, polyimides, polyamideimides, polyetherimides, polyetherketones, polyaryletherketones, polyetheretherketones, polyetherketoneketones, polyamides, copolyamides, polyesters, liquid crystalline polyesters, polyetheresters, polyetheramides, polyesteramides, polyestercarbonates, poly(alkylene dicarboxylates), poly(ethylene terephthalate), poly(1,4-butylene terephthalate), poly(trimethylene terephthalate), poly(ethylene naphthalate), poly(butylene naphthalate), poly(cyclohexanedimethanol terephthalate), poly(cyclohexanedimethanol-co-ethylene terephthalate), poly(1,4-cyclohexanedimethyl-1,4-cyclohexanedicarboxylate); polyarylates, a polyarylate comprising structural units derived from bisphenol A, terephthalic acid, and isophthalic acid; addition polymers, homo- and copolymeric aliphatic olefin and functionalized olefin polymers, polyethylene, polypropylene,

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thermoplastic polyolefin, ethylene-propylene copolymer, poly(vinyl chloride), poly(vinyl chloride-co-vinylidene chloride), poly(vinyl fluoride), poly(vinylidene fluoride), poly(vinyl acetate), poly(vinyl alcohol), poly(vinyl butyral), poly(acrylonitrile), acrylic polymers, poly(meth)acrylamides, polyalkyl (meth)acrylates, poly(methyl methacrylate) polymers of alkenylaromatic compounds, polystyrenes, syndiotactic polystyrene; acrylonitrile-butadiene-styrene (ABS), and acrylonitrile-styrene-acrylate (ASA) copolymers; and blends thereof.

56. The method of claim 32 wherein the substrate layer comprises at least one cured thermoset resin selected from the group consisting of those derived from epoxys, cyanate esters, unsaturated polyesters, diallylphthalate, acrylics, alkyds, phenol-formaldehyde, novolacs, resoles, bismaleimides, PMR resins, melamine-formaldehyde, urea-formaldehyde, benzocyclobutanes, hydroxymethylfurans, and isocyanates.

57. The method of claim 56 wherein the substrate layer further comprises a filler selected from the group consisting of glass fibers, carbon fibers, at least one thermoplastic resin, and mixtures thereof.

58. The method of claim 32 wherein the substrate layer comprises a filled, cured thermoset resin selected from the group consisting of reaction injection molding (RIM) compound, long fiber injection polyurethane (LFI-PU) foam, sheet-molding compound (SMC), bulk molding compound (BMC), thick molding compound (TMC), and an acrylic ester-derived thermoset resin comprising a polyphenylene ether.

59. The method of claim 32 wherein the substrate layer comprises at least one metal selected from the group consisting of aluminum and steel.

60. The method of claim 32 wherein thicknesses of layers are: a coating layer of about 2-2,500 microns; a second layer of about 2-2,500 microns; and an adhesive layer of about 8-2,500 microns.

61. A method for making a multilayer article assembly comprising (i) a coating layer comprising a block copolyestercarbonate comprising structural units derived from unsubstituted resorcinol, a mixture of isophthalic acid and terephthalic

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acid, and bisphenol A; (ii) a second layer comprising a bisphenol A polycarbonate optionally containing at least one colorant, (iii) an adhesive layer selected from the group consisting of a polyurethane; an aliphatic polyurethane film; a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene; and a blend of (A) a block copolymer comprising a thermoplastic polyurethane block and at least one block comprising structural units derived from styrene, and (B) a resinous copolymer comprising structural units derived from styrene; and (iv) a substrate layer comprising at least one material selected from the group consisting of a thermoplastic resin, a cured thermoset resin, a metal, a ceramic, a glass, and a cellulosic material;

wherein the coating layer is in contiguous contact with the second layer, and the adhesive layer is in contiguous contact with the second layer and the substrate layer; and wherein the multilayer article assembly following curing of the substrate material exhibits a ninety-degree peel strength of at least 700 Newtons per meter.

which method is selected from the group consisting of the method (i) comprising the steps of (a) preparing an assembly of coating layer and second layer, and (b) combining said assembly with separate adhesive layer and substrate layer; the method (ii) comprising the steps of (a) preparing an assembly of coating layer and second layer, (b) forming the adhesive layer adjacent to the substrate layer, and (c) combining said assembly with the adhesive layer / substrate layer combination; and the method (iii) comprising the steps of (a) preparing an assembly of coating layer, second layer, and adhesive layer, and (b) forming said assembly adjacent to the substrate layer.